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ABSTRACT

Twenty activities are described that can be used to develop map and compass skills in elementary grades. The activities range from simple, beginners' projects to more complex tasks as students acquire more skills. Most can be carried out in the classroom, schoolyard, or local neighborhood. Map activities include drawing maps of the classroom, mapping an imaginary island using scale and contour lines, and constructing a cardboard box plane table to use when compass or other surveying equipment is not available. Learning position and location can become enjoyable by playing a classroom detective game. One student leaves the room and then must return and identify an unknown object by asking classmates "yes" and "no" type questions about its location. Treasure hunts which require students to follow compass readings for specified distances are also suggested. For advanced students, orienteering activities can be applied to classroom, schoolyard, or neighborhood, and can make use of bicycles, canoes, or simple hiking and running. An adaptation is provided for persons confined to wheelchairs. Sample diagrams and maps accompany many of the suggested activities. (AV)

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INSTRUCTIONAL ACTIVITIES SERIES IA/E-9

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MAP AND COMPASS SKILLS FOR THE ELEMENTARY SCHOOL

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by

Robert P. Larkin and Paul K. Grogger
Department of Geography and Environmental Studies
University of Colorado
Colorado Springs, Colorado

It is important that the development of map and compass skills should start in the elementary school and continue through the secondary level. This article presents a series of activities that can be used to develop map and compass skills in the elementary grades. Included in this article are activities based around the classroom, schoolyard, or in a local park. Most of the activities can be modified to meet the needs of a particular teacher or class and sources are given for additional games and instructional aids.

MAP ACTIVITIES

Symbol Game

Understanding map symbols is an important aspect in the development of map skills. The "Symbol Game" is an activity designed to familiarize students with some of the common symbols used on topographic maps. The procedure for the game is relatively simple. The teacher must first decide which symbols are to be learned. The next step is to find a topographic map with those symbols on it; then outline each symbol on the map and place a number next to the symbol.

The class is next divided into groups or teams of five or six students. A master map for each group with the outlined symbols is placed on the wall at one side of the classroom. The first student in each team goes to the master map and finds the symbol numbered one. The student must determine what the symbol is and then return to the team and write down the name of the symbol. After the first student is finished the next student goes to the master map and determines what the number two symbol is and then returns to the team. This process is continued until all the symbols have been tentatively identified. The winning team is the one which finishes the activity in the fastest time and is the most accurate.

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Classroom Map

A classroom map can be an interesting, informative, and easy first step in the process of familiarizing students with maps. Although the map can be drawn by the instructor and presented to the student, it is more effective to have the students draw the map.

Give each student a sheet of paper that is not larger than the writing surface the student will use as, well as a ruler and possibly a tape measure. If the teacher deems it worthwhile, have the sheet represent the classroom by having the edge of the paper represent the actual outline of the classroom. If the paper is not an exact representation, have the students outline the classroom on the paper using a ruler. A scale can be developed by using the tape measure or by pacing the distance. Draw a north line somewhere on the map. An interesting discussion can develop between the students and the instructor as they try to determine how such a direction can be plotted. Some ideas that have been discussed are (1) the location of the sun rising and setting and the line drawn between these two points, which is divided by a perpendicular line, which points north, (2) using the north star, Polaris, (3) the location of the greatest amount of moss on the north side of trees, (4) a compass, although it should be stated that this line may be far from true north, (5) by using a map of the surrounding area that is oriented with the classroom, or (6) at noon, not Daylight Savings Time, the sun is directly south.

Next draw in any irregularities along the walls such as bookshelves, wall cabinets, doors, and windows. Then draw the furniture which is located against the walls and finally the other funiture in the center of the room.

Locations on the map can be identified by writing the names of students in their seating area, identifying the instructor's desk, and naming the furniture.

Have the students orient the map, using the north line. The location of all objects on the map should be able to be exactly located by looking at the map and then looking in the direction indicated by the map.

Another exercise for basic map understanding involves using clay, wood, or paper to develop a three-dimensional model of the classroom or the schoolyard. The same general directions as in developing the classroom map are used. However, the student must think of the vertical dimensions as well as the horizontal directions. Therefore, the height of objects must also be measured. Clay, soft wood, or stiff paper and glue will be needed. It is suggested that wood be used only if the students are old enough to use carving tools or the teacher prepares the objects before hand. If students map the schoolyard, this exercise can be used to initiate the use of compass methods because the larger area will be difficult to measure with a tape measure and eye sighting.

Imaginary Island Map

The objective of the "Imaginary Island Map" is to have each student create his or her own map of an imaginary island. The students should be encouraged to use symbols they have learned and incorporate those symbols into the map. The students should be given much freedom in the creation of their island map and, if necessary, they should develop new symbols.

This activity can be as simplified or as complicated as the students' abilities. For example, the more advanced students might be able to draw contour lines on their map or may be able to make the map at a certain scale. Those students with less skill will have a much simpler map. After each student has completed his or her map they can exchange maps and try to figure out each others map.

Map-Quarter Exercise

This is a simple activity but it is extremely effective in developing the concepts of scale and symbolization. A large picture is divided into four quarters. Each quarter is outlined and numbered. The students are then divided into four groups. Each group must take a specified quarter of the picture and draw a map of it. It is important to separate all the students to make sure they don't see what the other students in the class are drawing. The students can use crayons, pens, pencils and any size piece of paper he or she chooses. When the students are all finished each must find three other students who have done the other three quarters.

The results of this match-up are very interesting and often funny. Students will not all use the same symbols and a comparison and discussion of the symbols used is usually a very rewarding experience. Different scales will also be used and thus afford the opportunity for an interesting discussion of the concept of scale.

Cardboard Box Plane Table Exercise

A plane table is a mapping instrument that is used when a compass or more sophisticated surveying equipment is not available. A plane table is usually very expensive but by using two cardboard boxes a useful plane table can be constructed. Besides the boxes, unlined paper, a 12 inch ruler, map tacks, masking tape, and a pencil with an eraser will be needed.

Attach the two boxes together. The size of the boxes will be determined by the height of the persons using the finished plane table. The top of the instrument should be about chest height. Tape a sheet of unlined paper to the top of the plane table. Push two map tacks into the 12 inch ruler, each the same distance from either end. The ruler will be used as a sighting guide. Mapping can now begin.

Determine the area to be mapped and find two objects which are the farthest apart and will be on the map. Place the plane table near one of these objects and drive a stake into the ground (Station 1, Fig. 1) next to and behind the plane table. Leave the plane table and walk to a point that is near the edge of the area being mapped and drive in another stake (Station 2, Fig. 1). Measure the distance from stake to stake. This can be done by pacing or actually measuring the distance with a measuring chain ar string which can then be measured by a ruler. This is the only measurement needed during the drawing of the map (Table 1). Pick a point on the paper which can be used as a starting point. Care must be taken so that the point will allow the rest of the map points to be placed on the map. Mark the starting point with a pin and place the edge of

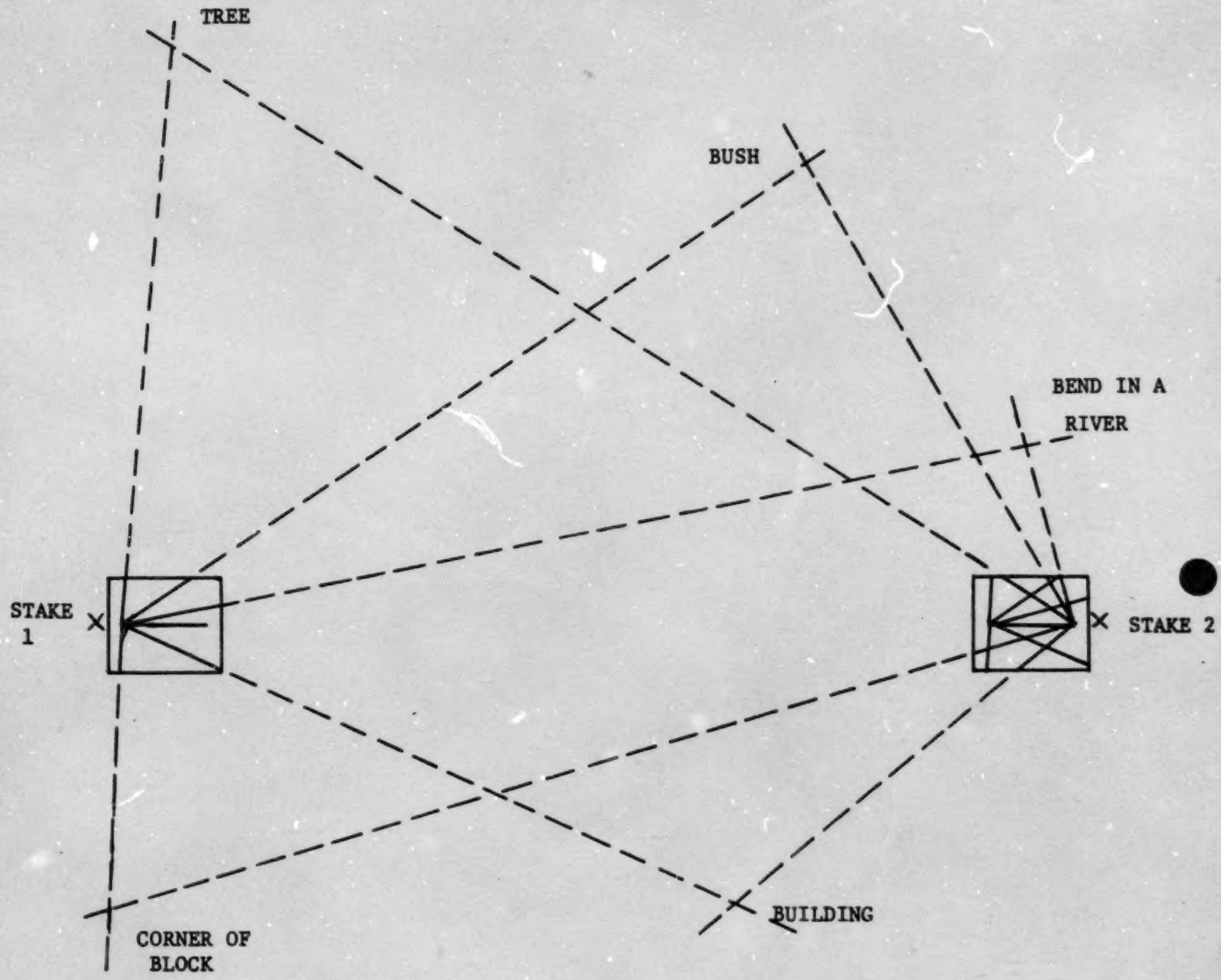

TREE
BUSH
BEND IN A
RIVER
STAKE
1
STAKE 2
BUILDING
CORNER OF
BLOCK

Figure 1

Table 1

Using a paper 8" wide, the following scales and distances will develop:

Scale	Width of Map
1" = 100'	800'
1" = 80'	640'
1" = 60'	480'
1" = 40'	320'
1" = 20'	160'

the sight ruler against the pin. Sight along the ruler, over the pins, so that the tops of the sight ruler's two pins are lined up with Station 2. Make sure the ruler stays against the pin and does not move as a line is drawn from Station 1 toward Station 2.

After drawing this line it is time to start locating other features to be included on the map. Aim at each feature by sighting along the ruler and lining the map pins up with the feature. Make sure the plane table does not move! Draw a line from Station 1 toward the feature along the full length of the ruler, making sure the ruler does not move. Near the end of the line write the name of the appropriate feature (Fig. 1).

Change the location of the plane table to Station 2. By using the measured distance from Station 1 to Station 2 place a pin on the paper map at the location of Station 2. Place the ruler against this pin and orient the plane table so the ruler lies exactly along the line extending back to Station 1. Be careful not to move the ruler from the pin nor the plane table from this orientation. Sight along the ruler and line up the pins with each feature you are including on the map. Draw a line along the ruler toward each feature. This line will cross the line extending from Station 1 to the feature. Where the two lines cross is the location of the feature on the map (Fig. 1). Each feature can be located in this manner. If other stations are necessary, the same sequence of development is used.

By using this method a map of a schoolyard, classroom, and environmental or recreational area can be developed.

Nature Trail Development

One way to use the mapping and compass skills learned to this point is to have the students develop a nature trail in the area surrounding the school.

The first step is to have the students scatter about the surrounding area after the boundaries of the project are explained, using a map of the area. The map can be a topographic map, a service station map, or city map from a local bank or the Chamber of Commerce.

As the students find interesting places they can develop a sketch map. The locations to be included in the nature trail can be spots that the students presently understand or spots that they need help with and are interested in. After the students come back to the school all the locations are placed as closely as possible at the correct location on the map of the area.

The next step is to number the locations in the possible order they will be visited. Then go to the starting point, perhaps the main door of the school, and take a compass bearing on the first point. Measure the distance and with the direction and distance known, plot the first point exactly on the map. Discuss the importance of the first point. In order to assure discussion of each location the students should write down the known information about the location in one column and questions in another column. Discuss both columns.

Continue from point to point until the map is complete. This exercise can also be completed using the plane table described in the plane table exercise. After returning to the school a discussion of what topics should be included at each point can take place. After all points are discussed, a final map can be drawn and the nature trail information sheet can be developed. The map and sheet will allow other students to take advantage of the developed nature trail.

Each stop along the nature trail can be identified by a small sign or plastic card.

POSITION AND LOCATION ACITIVITIES

Frequently children are asked to describe where an object is located. Answers to such questions as "Where is your classroom?" or "Where is your book?" require a description of an object's position. The concepts of location and position are central to the development of map and compass skills.

Usually when specifying the location of an object it is done in relation to another object. For example, a student might say that his or her classroom is next to the cafeteria. The cafeteria is the reference object used to help locate the student's classroom. It is therefore important to use reference objects that are easy to locate and identify, otherwise they cannot be useful guides to the object whose position is being described. The lack of useful reference guides is one of the reasons it is difficult to give instructions for locating an object to a person who is not familiar with a particular area. The difficulty of describing relative position becomes even more difficult when there are no obvious external reference objects. Consider the problem of describing the position of a cloud as seen from an airplane window.

The purpose of this section is to present activities that can be used to develop the concepts of position and location. The activities should be taught in sequence to insure maximum clarity and ease of teaching. The compass activities have been designed around a compass that has a movable protractor dial and a rectangular baseplate. For teachers unfamiliar with the compass it is suggested that they refer to the book Be Expert With Map and Compass by Bjorn Kjelstrom. This is an easy to understand book that goes through a step by step procedure relative to compass use.

Position Games

The location of objects in the classroom is a simple activity but is very useful in developing location skills. For example, the teacher can describe the position of an object in the classroom. The teacher might say, "The object I want you to locate is in front of me and to my left. It is between my desk and the chalkboard and above the waste paper basket." When first using this activity it is important to give a detailed and accurate description with several reference objects so as to discourage guessing by the students on the basis of incomplete information. After a few detailed descriptions the teacher should then give descriptions that would fit several objects to illustrate the difficulties encountered when one is given such descriptions. After this there can be a discussion of what is needed in order to be more precise. For a further variation of this game, the teacher can have the students take turns describing the position of objects in the room.

Another activity useful in developing location skills is the "Detective Game". In this game a student is asked to leave the room; he or she is the detective. After this student leaves the room, the class selects a mystery object somewhere in the room. When the "Detective" returns to the room, he or she has to identify the mystery object. Each question can only be answered with a "Yes" or "No". For example, the "Detective" might ask, "Is it near the bookshelf?" or "Is the mystery object below the windowsill?"

A variation of the above activities can include the use of a map instead of the classroom. An object can be located on a map. For example, a map of the school may be used and the teacher can say, "I want you to locate a room across the hall from the auditorium and next to the gymnasium." The "Detective" has to find an object or place on the map and everyone in the class has a copy of the map and can answer the "Detective's" questions with either "Yes" or "No".

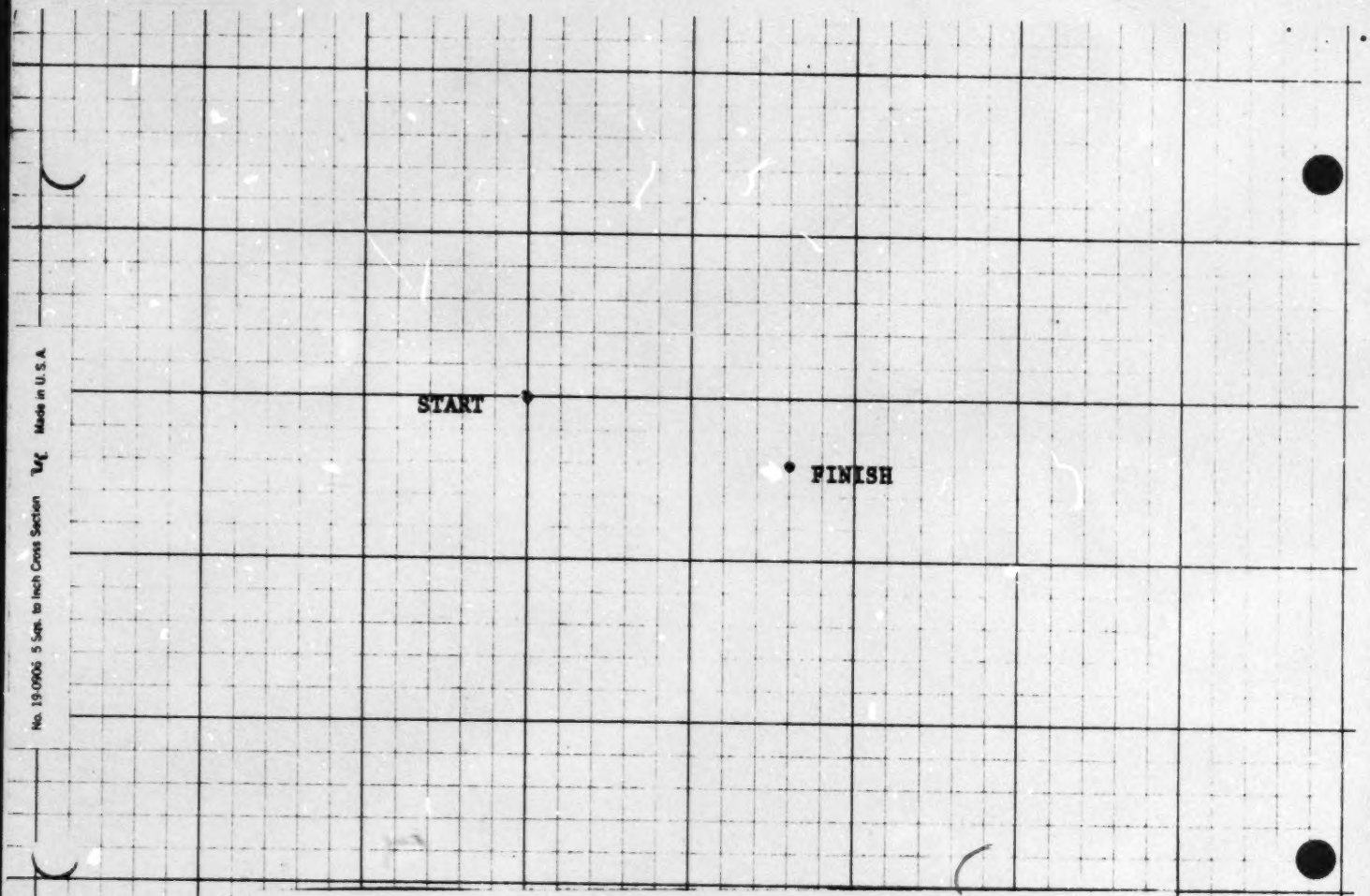
Point Journey Game

The object of the game is to draw a path from a starting point to a finish by following the directions made available by the instructor. An example game is illustrated in Figure 2. Directions other than those used in Figure 2 can be easily developed by the instructor.

This activity can be developed into a competitive event by having the children all start at the same time. The winners are determined by the fastest completions of the journey without error.

An excellent variation of the Point Journey is the art game which also develops direction and distance abilities. By following the available directions, the student will draw a picture.

As with the Point Journey, the instructor can develop different directions so the students' drawings can be of different designs and pictures. To develop new directions, place a piece of grid pattern tracing paper over the picture to be drawn. Trace the picture on the grid tracing paper and then, starting at an appropriate point, develop the necessary directions and distances for each instruction. An example of this activity is illustrated in Figure 3.



Draw a line one square S, go two squares W, continue three squares S, then four squares E, two squares N, three squares E, two squares N, four squares E, one square S, three squares W, two squares S, and two squares E.

Figure 2

Figure 3

1. 3 N	9. 2 S	16. 1 N	23. 2 N	30. 1 NW
2. 2 NW	10. 1 SW	17. 1 W	24. 4 E	31. 2 N
3. 12 W	11. 5 S	18. 3 N	25. 2 NE	32. 4 NE
4. 6 SW	12. 1 SE	19. 1 E	26. 1 N	33. 4 NW
5. 15 S	13. 1 E	20. 1 NE	27. 1 NE	34. 3 N
6. 4 SE	14. 4 S	21. 5 N	28. 1 NW	35. 1 NW
7. 3 S	15. 3 E	22. 1 NW	29. 1 NE	36. 1 N
8. 6 E				37. 1 NE

For further information on the development of location and position concepts, the Science Curriculum Improvement Study (SCIS) project has developed a unit entitled "Relative Position and Motion" that has been published by Rand McNally.

Hunt the Penny

This is a simple activity that can be used to develop the students' ability to set bearing on a compass and then follow the selected bearings. This activity focuses only on compass skills and doesn't involve distance or map skills. To start the game the student selects a spot in a school yard or open field and then marks that spot with an object (notebook, quarter, penny, etc.). The object of the game is to start at the marked spot and after following a triangular course return to the marked spot (Fig. 4). For example, the student starts with a bearing of 26 degrees. After walking a specified number of paces (variable) the student stops and adds 120 degrees to the original bearing, thus the new direction (146 degrees) and stops again. At this point another 120 degrees are added and a new bearing (266 degrees) is taken. This new bearing should lead the student back to the original marker. Many varieties of this game can be developed. For example, by adding 90 degrees on each of four legs, a square is described. As more legs are added the game gets more complex (Fig. 4).

Schoolyard Compass Game

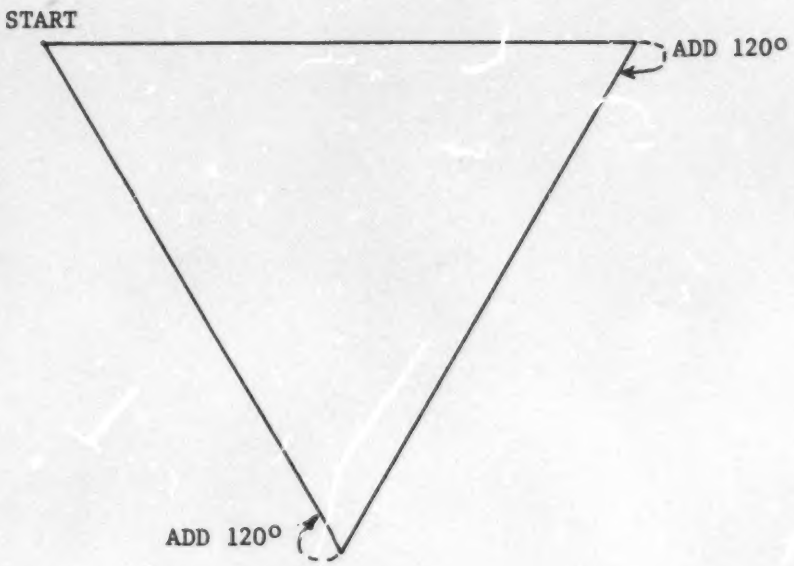
This game can be played in any open area such as a football field, park, gymnasium or schoolyard. The student must be able to set and follow a compass bearing in order to play. Eight labeled markers are placed around a large circle and labeled I, O, U, L, Z, E, A, and P. An unlabeled marker is placed in the center of the circle (Fig. 5). The radius of the course may be changed to suit either the available space or the number of players participating in the game. Setting up the game in a wooded area, with streams, rocks, and bushes will make the game more interesting and challenging.

The participant in the game receives an instruction card that indicates the starting position as well as bearings which direct him or her around the course from marker to marker (Fig. 6). The player copies down the letter on each marker along the route and at the finish a six-letter code is produced. This code is checked against an answer sheet and if the student player followed the correct bearings, the code should be the same as the one on the answer sheet. This is a relatively simple game to set up and play; however, the teacher may wish to purchase instructions and score cards from the Silva Company, 2466 Stae Rd. 39N, La Porte, Indiana 46350.

Treasure Hunt

Most students enjoy a treasure hunt, but rather than just leaving the finding of the prizes to luck and a search, map and compass skills can be developed through the following exercise.

The instructor must first develop a list of directions. Start at a point and take a bearing on the location where a prize will be placed. Pace off the



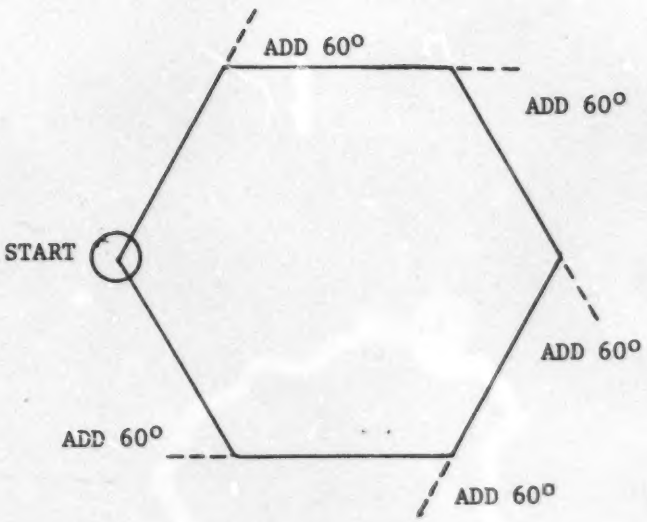


Figure 4

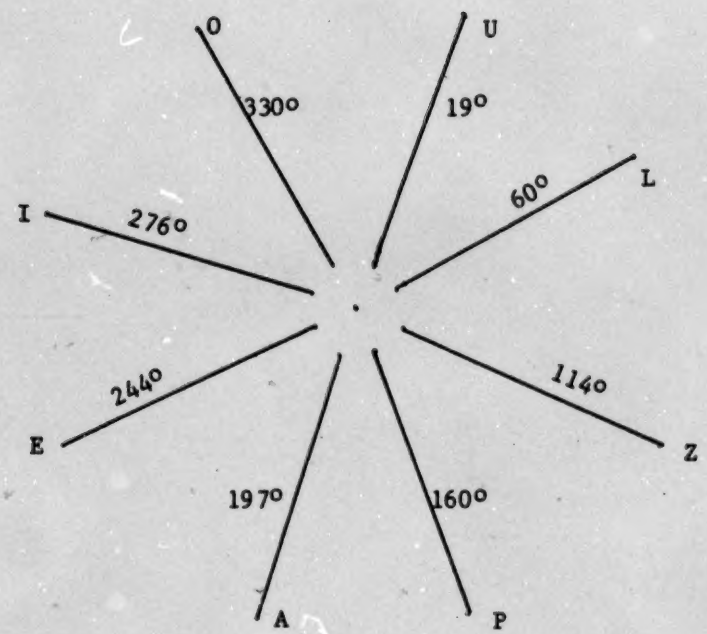


Figure 5

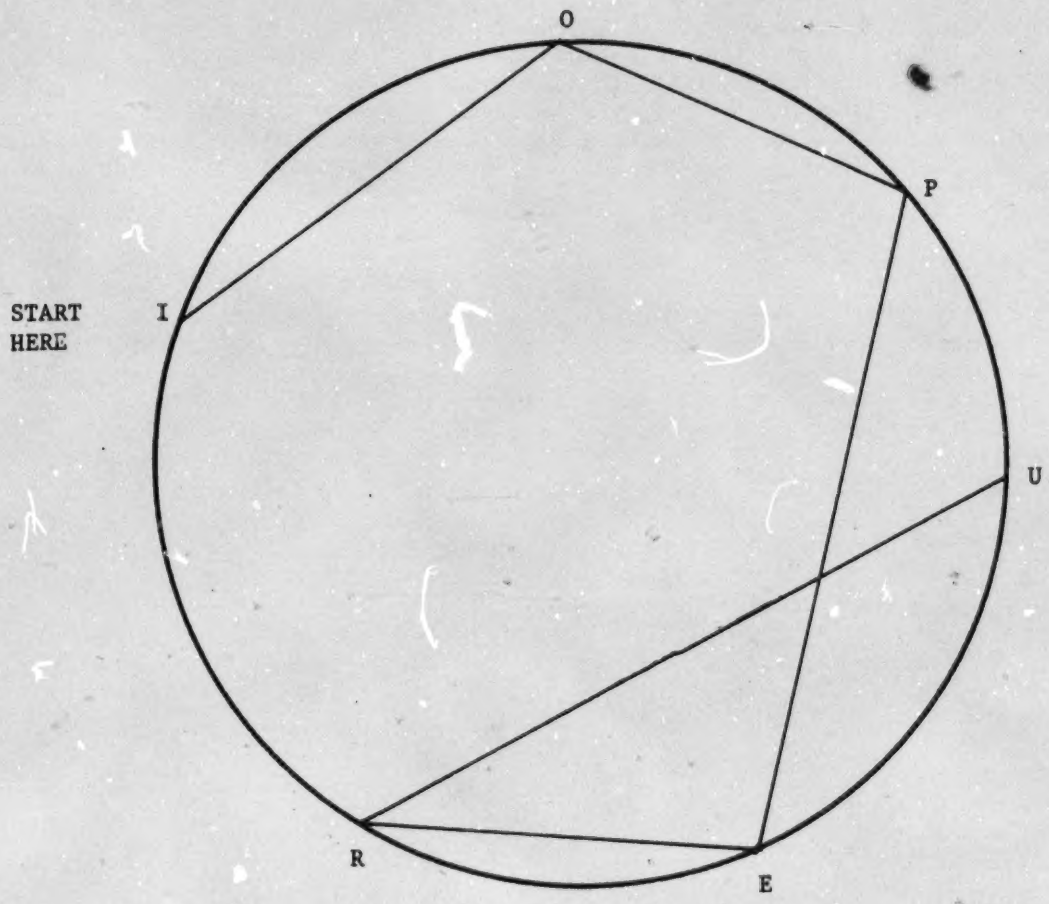


Figure 6

distance so the correct distance can be included in the directions. From the prize location take a bearing on another prize location, pace off the distance and continue the development of the instructions in the same way until all the prizes are hidden.

There can be many variations of the game. Students can either start at the same point or at different points. Of course the latter method takes much longer to lay out. Another method is to start all the students on the same first bearing, give each child a completely different bearing for the second prize, and then make the third prize the same for all the students. The variety of changes from this point on is endless. These variations are especially appropriate for a class with children of greatly different abilities since it allows all children to succeed and earn a prize.

Compass Baseball

Another competition is Compass Baseball. The regular rules of baseball are used with one exception; each fielder and each runner must take a bearing before throwing or running. An example follows: the batter hits a ground ball to the shortstop. Immediately the batter takes a bearing on the location of the shortstop and the ball. The batter calls out the bearing to the umpire who has also taken the same bearing. If the batter's direction is correct, the umpire tells the batter to run. While the above is occurring the shortstop takes a bearing on first base and upon determining the correct bearing calls it out to the umpire, either the third or second base umpire, who has also been taking the bearing. If the shortstop is correct, the umpire tells the player to throw. Naturally, there must be some leeway in the amount of error allowed in the bearing determinations. This would need to be determined before the start of the game and would depend on the ability of the players. Because of the time it takes to play this variety of baseball, three innings is normally the length of the game.

ORIENTEERING

The ability to integrate map and compass skills can easily be developed through the sport of Orienteering. A national, mass participation sport in Sweden, where it is a compulsory subject in the schools, Orienteering is exciting, stimulating, and a great developer of mind and body coordination.

Orienteering is a walking road rally where each participant makes his or her way from one indicated point on a topographic map to another, combining judgment and skill in map reading, use of the compass, recognition of landmarks, and the ability to move cross-country. It provides an opportunity for the elementary school teacher to develop map and compass skills as well as being an enjoyable and healthful activity for children.

Advanced Orienteering students have to be familiar with many aspects of map-reading including symbols, scale, direction, declination, orientation, and have a thorough knowledge of contour lines. For younger children or children with few

map skills, simple forms of Orienteering can be used whereas more advanced students can participate in more sophisticated activities.

Classroom Orienteering

The simplest and easiest Orienteering activity involves the use of the classroom. The teacher, with the use of an overhead projector and a piece of clear plastic and a grease pencil, draws a map of the classroom. This map should include the desks in the room as well as the chalkboard, teacher's desk, windows and other distinguishing features (Fig. 7).

After the map has been drawn and the students become familiar with the map and its relationship to the actual layout of the room, the teacher should draw circles on the map indicating selected points in the room. For example, some of these points might include the corner of a desk, a doorway, a windowsill, or a corner of the room (Fig. 7). These circles become the basis for the classroom Orienteering activity.

Before the class starts or when the students are out of the room, the teacher tapes a small numeral or letter at the points designated on the map, preferably in places where the students will not be able to readily see them. Thus, after the teacher finishes the map on the overhead projector and puts on the appropriate circles, the class is divided into pairs and each pair must find in the classroom the designated points on the map and the appropriate letters. The pair that finds all of the letters fastest can be the winner or, to make the game less competitive, after all the letters are found the pair of students have to make a word phrase from the letters. Therefore the "winner" is not necessarily the pair that finds the letters the fastest, but is the pair that figures out the word or phrase the quickest. For example, in Figure 7 the key word is HISTORY. In order to make the game a little more difficult and challenging for the more advanced classes, the transparency map can be rotated on the overhead projector so it is not oriented with the actual classroom. The students, therefore, always have to orient themselves with the map and the classroom. If numbers are used instead of letters, the winners can be the pair that adds them up or performs some other mathematical function the fastest.

Schoolyard Orienteering

The schoolyard Orienteering activity is similar to classroom Orienteering, but instead of using the classroom the schoolyard is used. A plan map of the schoolyard is drawn on a ditto master and each student or pair of students gets a map. The map has circles indicating specific points in the schoolyard. At each of these designated points a letter or number is taped or fastened to an object such as the corner of a building, a fence, a tree, etc.

As in the classroom Orienteering activity, the object of the game is to go to all the points in the schoolyard designated on the map with a circle and copy down the letter or number. The students can go to the points in a random order or in a designated order. In order to be proficient at this activity, the student must be able to read the map accurately and always keep it oriented so features in the landscape are oriented with the map. Route selection is also impor-

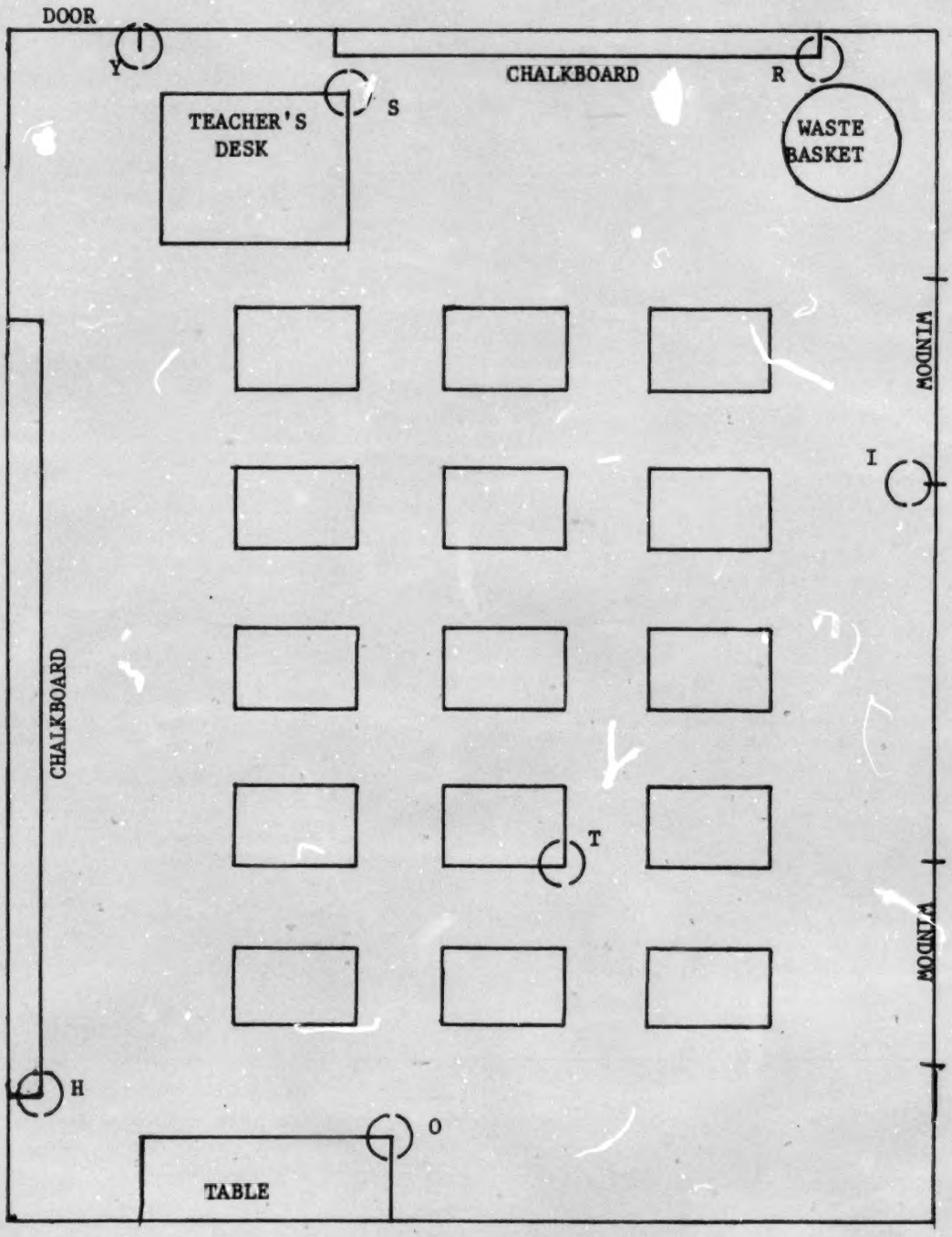

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Figure 7

tant in that the quickest route between two points may not be the straight line choice. The student must discern this from the map and select the best route. Thus, the student in the best physical condition will not always be the winner. Of course, the activity can be done without any competition among participants if the teacher so desires. Similar to the classroom activity, the letters found at the designated points could be put together to spell a word or phrase.

Route Orienteering

Route Orienteering can take place around a school or in a park or somewhat open area. A course is marked out on the ground with colored streamers or markers. The course should be set up so the route can be seen and followed easily by the participants. A number of control markers with letters or numbers are placed along the route. When the participant comes across one of these markers along the route he or she must mark on the map exactly where the marker is located. The length of the course can depend on the map ability and physical condition of the students.

This type of Orienteering course should pass through as many fixed or easily recognized points as possible, such as hilltops, path or road junctions, streams, lakes, etc. This gives the participant a chance to reconfirm his or her position on the map. The game can be made competitive by having the students complete the route as quickly as possible. Penalty points can be assessed for any error in estimating the position of the various control markers passed en route. For example, three minutes could be added to each participant's time for every 1 cm. error in the placing of a dot indicating the position of the control marker.

Cross-Country Orienteering

Cross-country Orienteering is the most interesting and most competitive of Orienteering events. It involves skill in reading topographic maps and in the use of the compass. Competitors leave a starting area at one-minute intervals and have to find their way to a series of control markers. The position of the control markers are indicated on a map given to each participant prior to their leaving the starting area. The order in which the control markers must be visited is designated and the winner is the participant that circulates around the course the fastest.

The control marker is a flag or marker of some kind with a letter or number attached. When the participant reaches a control marker he or she marks down the letter or number on a scorecard. In some cases a punch is used to mark the scorecard. Cross-country Orienteering involves the application of many map and compass skills with the critical concept being that of selecting the best route. The straight-line route between two control markers is rarely the best choice. Many factors such as obstacles like rivers or swamps, the nature of the ground, cliffs, and an easier route not too far away are important considerations. As students become more familiar with the map and compass their Orienteering ability progresses accordingly.

Besides the usual cross-country Orienteering competition of running, several

variations can be used to check the student's map and compass skills.

An Orienteering course can be set up and the participants be required to complete the course on bicycles. Whether the bicycles must be used at all times or whether some check points can be located without the bicycle would be up to the meet organizer who will take into account the difficulty of the terrain and the ability of the participants. This will especially be true if the check points are located close to paths, trails, and roads.

Another variation, to be used by students with water abilities, is the canoe or swimming Orienteering. The competition can be completed with check points on land and the majority of the travel by canoes or swimming; however, a more unusual event, to be used in a smaller area or where check points cannot be hidden along shore very easily, is where the markers are placed below the water. This method tests compass skills primarily. Below-surface markers can be constructed from heavy duty balloons, rope, and a weight (Fig. 8). The marker is placed so the weight, which is connected to the marker by rope, holds the balloon below the surface. The more ability the competitors have the deeper the marker is placed. The competitors can take readings from one point to the next or use the landscape surrounding the water area for bearings. Rather than starting the competition by placing the location of the check points on the map, the competitors receive a list of compass bearings. Each competitor will receive one of several possible compass bearings lists and will have to go from one to the other in order or the bearings will not be usable. This should help with the problem of just watching where other competitors are finding markers and then duplicating their progress. The punch mark on the scorecard can easily be checked for errors.

A final type of Orienteering is designed for competitors who have a physical disability, in particular, the need for a wheelchair. This competition is the same as any Orienteering meet except that it is run in a large building and the maps are of the inside of the building rather than of the outdoors. Depending on the ability and age of the participants, the meet may be confined to one floor or be spread over as many floors or areas as the competitors can handle. One important point: make the competition challenging but not impossible. This is extremely important because these competitors need to succeed, but not be put into a situation they cannot hope to master.